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# Care of Ebola Survivors and Factors Associated With Clinical Sequelae—Monrovia, Liberia

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**Background.** The Eternal Love Winning Africa (ELWA) Clinic was the first clinic to provide free, comprehensive care to Ebola virus disease (EVD) survivors in Liberia. The objectives of this analysis were to describe the demographics and symptoms of EVD survivors at ELWA from January 2015 through March 2017 and to identify risk factors for development of sequelae.

**Methods.** Patients' demographic and clinical information was collected by chart review in June 2016 and March 2017. Associations with clinical sequelae were analyzed using the chi-square test, *t* test, and multivariate logistic regression.

**Results.** From January 2015 to March 2017, 329 EVD survivors were evaluated at ELWA. Most survivors experienced myalgia/arthralgia (73%; *n* = 239) and headache (53%; *n* = 173). The length of time from Ebola Treatment Unit (ETU) discharge to first clinic visit ranged from 0 to 30 months. Many visits (30%) occurred 24 or more months after ETU discharge. The proportion of visits for headache, weight loss, joint pain, visual problems, insomnia, fatigue, memory loss, decreased libido, depression, and uveitis decreased over time. More men than women had visits for depression; however, these differences were not significant. Symptom prevalence differed in adults and children; significantly more adults experienced myalgia/arthralgia (77% vs 44%), visual problems (41% vs 12%), post-EVD-related musculoskeletal pain (42% vs 15%), and insomnia (17% vs 2%).

**Conclusions.** EVD survivors frequented ELWA for EVD-related symptoms many months after ETU discharge, indicating a long-term need for care. Reported symptoms changed over time, which may reflect eventual resolution of some sequelae.

**Keywords.** Ebola; ELWA hospital; Liberia; Monrovia; survivors.

The 2014–2016 Ebola virus disease (EVD) epidemic resulted in >28 000 EVD cases and 11 000 deaths in West Africa [1]. There are an estimated 17 000 EVD survivors in West Africa, including an estimated 5000 survivors in Liberia. The Liberia Ministry of Health (MOH) maintains a registry of EVD survivors—persons who were admitted to an Ebola Treatment Unit (ETU) and tested positive for Ebola virus, and who subsequently tested negative for the virus on discharge from the ETU. However, only 1500 EVD survivors are registered in the Liberian MOH database [1].

Limited data exist regarding long-term consequences of EVD and optimal strategies for survivor care [2]. Studies of previous, smaller outbreaks noted that survivors suffered from arthralgias, fatigue, abdominal pain, ocular symptoms, hearing loss, and psychological symptoms [3–5]. Cross-sectional studies reported similar findings following the recent West Africa epidemic [2, 6–9]. Sequelae can have pronounced effects on survivor health and productivity [10]. Decreased visual acuity in

particular may lead to difficulties with employment and daily activities. Timing of sequelae onset and duration among survivors is poorly understood. In some instances, Ebola survivors can develop severe ocular and neurologic conditions, including uveitis and meningitis, late after recovery; in 2 well-documented cases, virus was detected in ocular and cerebrospinal fluid months after clearance of viremia [11, 12]. Follow-up from a 2007 outbreak in Uganda demonstrated that survivors experienced symptoms more than 2 years after ETU discharge [3].

The World Health Organization developed guidance regarding care of common EVD sequelae and highlighted the need for comprehensive support of the medical and psychosocial challenges experienced by survivors [13]. However, it may be challenging for survivors to access health care services. Survivors may face stigma within their community and in certain instances have lost their jobs and become isolated from the community [14].

The Eternal Love Winning Africa (ELWA) hospital is a privately funded health care facility in Monrovia, Liberia. The first confirmed EVD case in Liberia occurred in March 2014, and the peak number of confirmed EVD cases occurred from August to September 2014 [15]. In March 2014, ELWA opened the first ETU in Monrovia, and it later expanded to become the largest ETU in Liberia. As the number of EVD survivors increased and more EVD complications were identified, ELWA worked with Liberia's MOH-led Survivor Clinical Working Group to develop clinical guidelines to assess and treat survivors. In January 2015,

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ELWA established an EVD Survivor Clinic, which is open 5 days a week and has provided care to >300 patients.

We reviewed clinical data from EVD survivors at the ELWA Clinic to assess symptoms and diagnoses following resolution of EVD infection and to identify risk factors for development of sequelae. We hypothesized that symptoms may differ by gender and age group and that patients who reported depression may be more likely to experience additional symptoms compared with patients without depression, as symptoms may have a significant impact on mental health through negative effects on quality of life and earning potential.

## METHODS

### Study Setting

The ELWA hospital, located in Paynesville City, Monrovia, was founded by the international mission organization Serving in Mission (SIM) in 1965. The hospital provides low-cost comprehensive care to the community, including obstetrics, surgical care, primary care, dental care, pediatrics, and HIV care. In the aftermath of the 2014–2016 Ebola outbreak, EVD survivors with either an ETU discharge certificate or reported history of EVD illness were provided a medical care card that allowed them to receive care at the ELWA hospital for no cost. Diagnostic tests regularly available in the clinic included complete blood count, Widal test, C-reactive protein, erythrocyte sedimentation rate, malaria smear, HIV testing, urine pregnancy test, urinalysis, chest x-ray, and basic metabolic profile. Slit lamp ocular examination was dependent on the availability of trained clinicians.

### Data Collection and Analysis

In June 2016 and March 2017, we conducted a review of EVD Survivor Clinic outpatient medical charts dated January 1, 2015, through March 17, 2017. These dates were chosen to allow time between chart reviews and investigator availability. Patients were included in the analysis if they had a recorded ETU discharge date in their medical chart. The EVD Survivor Clinic used a standard form for each clinical visit, which collected historical information about dates of ETU admission and discharge, preexisting chronic conditions, and medical problems experienced while hospitalized with EVD. The form included a closed-ended list of medical problems experienced by patients since ETU discharge, and questions about self-reported depression and experiencing stigma. Physical exam findings, diagnoses, and medications prescribed were also recorded. Pediatric patients had a separate form with a similar structure.

Data were extracted from the above form using a data collection tool and entered into an electronic database. Demographic data, dates of ETU discharge and clinic visit, symptoms, and diagnoses at each visit were coded. Symptoms and diagnoses were coded by theme (eg, gastrointestinal and musculoskeletal) and keywords. The symptoms selected for analysis were based on being most frequently reported: headache, abdominal

pain, weight loss/decreased appetite, myalgia/arthritis, visual problems, weakness, insomnia, fatigue, poor memory, pain/numbness in extremity, post-EVD musculoskeletal syndrome, malaria, urinary tract infection (UTI), respiratory tract infection, pelvic inflammatory disease (PID), dyspepsia/reflux, hypertension, typhoid, palpitations, stigma experience, anxiety, diarrhea, erectile dysfunction, irregular menses, hearing loss, decreased libido, depression, and uveitis. Post-EVD musculoskeletal syndrome is a term used by ELWA clinicians to define musculoskeletal pain following EVD recovery not attributable to another cause. Criteria for other diagnoses and symptoms are listed in [Supplementary Table 1](#).

Statistical analysis was conducted using Stata 13 (StataCorp, College Station, TX). Time from ETU discharge was calculated by number of months from the recorded ETU discharge date to the date of clinic visit. Univariate analysis was performed using a chi-square test for categorical variables and *t* test for continuous variables. Multivariate logistic regression was used to determine the association between symptom prevalence and months from ETU discharge, adjusting for gender and age. Logistic regression analysis was also conducted to determine whether patients with depression were at greater odds of having a particular symptom or diagnosis, after adjusting for time from ETU discharge. The false discovery rate technique was used to adjust both the univariate and multivariate analyses with an overall alpha of .05 for multiple comparisons [16].

### Ethics Statement

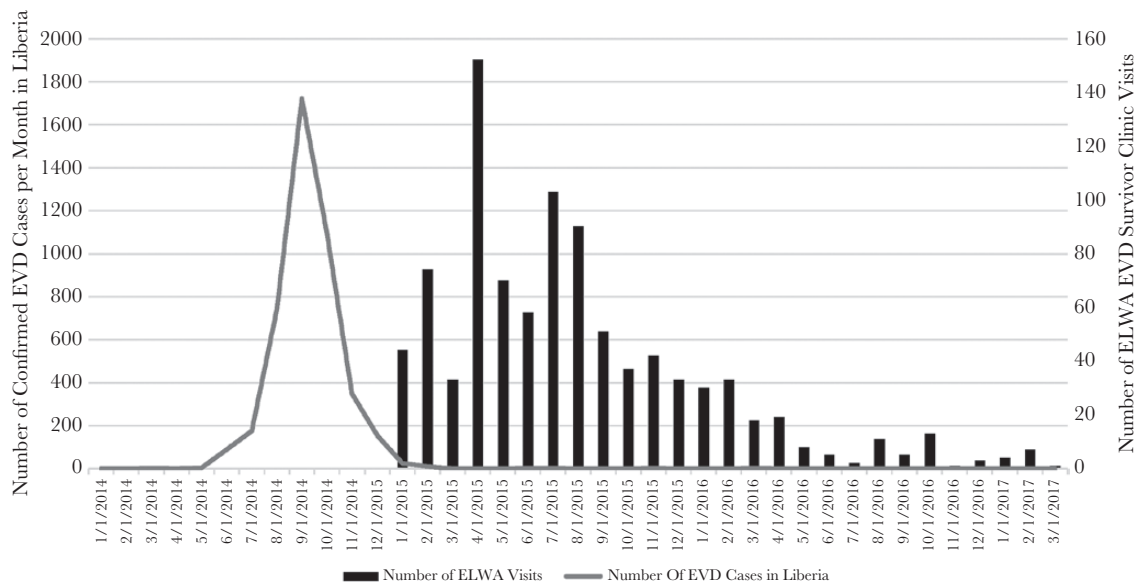
The project was reviewed and determined not to be human subjects research by the US Centers for Disease Control and Prevention and Liberia National Research Ethics Board.

## RESULTS

### Implementation and Chronology of the ELWA Survivor Clinic

In January 2015, ELWA opened the EVD survivor clinic in Monrovia and had a rapid increase in the caseload, with a monthly maximum of 152 recorded visits during April 2015 ([Figure 1](#)). Visits began to decline by September 2015, with fewer but consistent visits (20–40 per month) midway through 2016, and fewer than 10 visits per month at the time of data capture in 2017.

Medical records were available from 384 patients seen at the clinic from January 1, 2015, through March 17, 2017. Of these, 329 had a documented ETU discharge date. These 329 individuals contributed to 947 patient visits. The mean number of visits per patient (range, median) was 2.9 (1–33, 2). The mean age at first visit (range) was 33 (0.9–75) years ([Table 1](#)). Most patients were age (interquartile range) 18–49 (24–41) years, and 58% (95% confidence interval [CI], 53%–64%) of patients were female. The mean number of days since ETU discharge to first visit was 288 days. Most (60%; 95% CI, 57%–63%) patient visits



**Figure 1.** Comparison of number of confirmed Ebola virus disease (EVD) cases in Liberia and survivor clinic visits—January 2014 to March 2017. The monthly number of EVD cases in Liberia is compared with the number of EVD survivors seen at the Eternal Love Winning Africa (ELWA) Clinic per month. Bars represent the number of ELWA clinic visits per month, whereas the lines represent the number of EVD cases in Liberia (using World Health Organization data).

occurred 6–18 months after ETU discharge, although 11% (95% CI, 9%–13%) of visits occurred 24–30 months after discharge (Figure 2).

#### Symptoms and Diagnoses Observed

The most common symptoms experienced (Table 2) included myalgia/arthralgia (73%; 239/329), headache (53%; 173/329), abdominal pain (45%; 148/329), weight/appetite loss (41%; 135/329), vision problems (38%; 125/329), and fatigue (28%; 93/329). The most common diagnoses were post-EVD musculoskeletal syndrome (38%; 125/329), malaria (32%; 106/329), UTI (19%; 62/329), respiratory tract infection (11%; 36/329), PID (11%; 20/189), typhoid (9%; 30/329), and uveitis (5%; 16/329).

The symptoms and diagnoses of patients varied as the number of months from ETU discharge increased. There was a significant monthly decrease in the proportion of visits for headache,

weight loss, experiencing stigma, extremity numbness or pain, joint pain, visual problems, insomnia, fatigue, poor memory, post-EVD musculoskeletal syndrome, hearing loss, decreased libido, depression, and uveitis ( $P < .05$ ) (Table 3, Figure 3A and B). In contrast, there was a significant monthly increase in the proportion of visits for weakness, malaria, UTI, respiratory tract infection, and hypertension ( $P < .05$ ) (Table 3, Figure 3C). When the analysis was limited to patients with only 3 or more visits, the results were similar (Supplementary Table 2).

#### Treatment Provided

Patients were treated with antidepressants and anxiolytics (eg, amitriptyline, diazepam), acid-suppressing medications (eg, lansoprazole), cholesterol-lowering medications (eg, statins), anti-inflammatory medications (eg, oral or topical ophthalmologic steroids, nonsteroidal anti-inflammatory drugs), antihypertensive medications (eg, furosemide, nifedipine, beta-blockers, angiotensin-converting enzyme inhibitors), vitamins and iron supplements, antimalarials, antihelminthic medications, antibiotics (eg, amoxicillin, ciprofloxacin, ceftriaxone), and oral contraceptives. Referrals to group therapy, surgery, dentistry, and ophthalmology were made as needed. Counseling and education were provided on diet, exercise, and other healthy lifestyle modifications.

#### Comparison of Symptoms and Diagnoses by Gender and Age Group

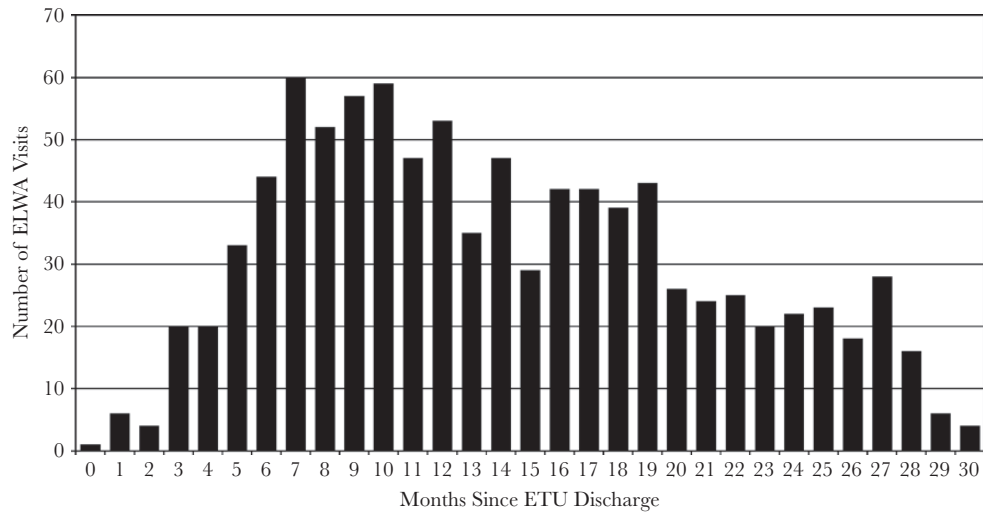
The prevalence of symptoms was stratified by gender (Table 2); however, these findings were no longer significant after adjusting for multiple comparisons.

Children <18 years of age comprised 13% of patients evaluated at ELWA (Table 1). Children had significantly more visits

**Table 1. Demographic Characteristics of Ebola Survivors at the ELWA Clinic**

Characteristic	Values
Sex, male/female, No. (%)	135 (42)/189 (58)
Mean age at first visit, y	33 (0.9–75)
Age group, No. (%)	
<5 y	9 (3)
5–17 y	32 (10)
18–49 y	230 (70)
50–64 y	26 (8)
>65 y	32 (9)
Mean time since ETU discharge to first visit, d	288 (4–909)

Abbreviations: ELWA, Eternal Love Winning Africa Clinic; ETU, Ebola Treatment Unit.



**Figure 2.** Total number of survivor clinic visits by months since Ebola Treatment Unit (ETU) discharge. The bars represent the number of patient visits occurring in the months elapsed from patient's recorded ETU discharge date. The totals include multiple visits by some patients over time. Abbreviation: ELWA, Eternal Love Winning Africa Clinic.

**Table 2. Prevalence of Symptoms and Diagnoses Recorded at Clinic Visits**

Symptom	Total <sup>a</sup> (n = 329), No. (%)	Males (n = 135), No. (%)	Females (n = 189), No. (%)	PValue <sup>b</sup>	Children (n = 41), No. (%)	Adults (n = 288), No. (%)	PValue <sup>b</sup>
Myalgia/arthralgia	239 (73)	96 (71)	141 (75)	.48	18 (44)	201 (77)	<.001 <sup>c</sup>
Headache	173 (53)	63 (47)	109 (58)	.05	15 (37)	141 (54)	.038
Abdominal pain	148 (45)	52 (39)	95 (50)	.036	17 (38)	119 (45)	.62
Weight loss/appetite loss	135 (41)	51 (38)	84 (44)	.23	12 (29)	112 (43)	.10
Vision problem	125 (38)	55 (41)	69 (37)	.44	5 (12)	108 (41)	<.001 <sup>c</sup>
Fatigue	93 (28)	36 (27)	57 (30)	.49	5 (12)	77 (30)	.021
Pain/numbness in extremity	60 (18)	30 (22)	30 (16)	.15	3 (7)	53 (20)	.047
Gastritis	54 (16)	24 (18)	29 (15)	.56	5 (12)	46 (18)	.39
Insomnia	50 (15)	20 (15)	30 (16)	.79	1 (2)	44 (17)	.016 <sup>c</sup>
Weakness	46 (14)	16 (12)	28 (15)	.44	8 (20)	38 (13)	.27
Irregular menses	-	-	24 (13)	-	-	-	-
Experiencing stigma	10 (3)	6 (4)	4 (2)	.23	-	-	-
Decreased libido	33 (10)	16 (12)	17 (9)	.4	-	-	-
Diagnosis							
Post-EVD musculoskeletal disease	125 (38)	48 (36)	76 (40)	.39	6 (15)	109 (42)	.001 <sup>c</sup>
Malaria	106 (32)	18 (13)	45 (24)	.02	15 (37)	46 (18)	.005 <sup>c</sup>
Urinary tract infection	62 (19)	17 (13)	45 (24)	.01	2 (5)	56 (21)	.012 <sup>c</sup>
Respiratory tract infection	36 (11)	17 (13)	18 (10)	.38	11 (27)	24 (9)	<.001 <sup>c</sup>
Pelvic inflammatory disease	-	-	20 (11)	-	-	-	-
Typhoid	30 (9)	11 (8)	19 (10)	.56	4 (10)	24 (9)	.91
Uveitis	16 (5)	6 (4)	10 (5)	.73	-	14 (5)	-
Depression	42 (13)	23 (17)	18 (10)	.045	2 (5)	39 (15)	.089
Anxiety/worried	44 (13)	18 (13)	26 (14)	.91	3 (7)	37 (14)	.23
Poor memory	41 (12)	15 (11)	26 (14)	.48	2 (5)	34 (13)	.13
Palpitations	40 (12)	13 (10)	27 (14)	.21	1 (2)	36 (14)	.039
Erectile dysfunction	-	11 (8)	-	-	-	-	-
Hypertension	22 (7)	10 (7)	11 (6)	.57	-	-	-
Hearing loss	19 (6)	7 (5)	11 (6)	.81	2 (5)	14 (5)	.897
Diarrhea/gastroenteritis	14 (4)	5 (4)	8 (4)	.81	4 (10)	9 (3)	.06

Abbreviation: EVD, Ebola virus disease.

<sup>a</sup>In some instances, total includes patients without a sex or age recorded.

<sup>b</sup>P value is significant after adjusting for multiple comparisons.

<sup>c</sup>Univariate analysis using X<sup>2</sup>, adjusting for multiple comparisons.

**Table 3. Association of Symptoms/Diagnoses With Increasing Months From ETU Discharge<sup>a</sup>**

Symptom, Complaint, or Diagnosis	Odds Ratio	95% Confidence Interval	P Value
Visual problem	0.9	0.87–0.92	<.001
Fatigue	0.92	0.88–0.95	<.001
Depression	0.87	0.82–0.93	<.001
Uveitis	0.79	0.73–0.86	<.001
UTI	1.1	1.04–1.1	.0001
Headache	0.96	0.94–0.98	.0004
URTILRTI	1.1	1.03–1.2	.0005
Post-EVD musculoskeletal syndrome	0.96	0.93–0.98	.0008
Decreased libido	0.90	0.85–0.96	.001
Malaria	1.04	1.02–1.1	.0011
Poor memory	0.9	0.86–0.96	.0012
Weakness	1.1	1.02–1.1	.0015
Joint pain	0.97	0.95–0.99	.0018
Hypertension	1.06	1.02–1.1	.0028
Insomnia	0.94	0.91–0.98	.0048
Hearing loss	0.87	0.78–0.96	.007
Weight loss	0.97	0.95–0.99	.0189
Experiencing stigma	0.84	0.73–0.97	.019

Abbreviations: ETU, Ebola Treatment Unit; EVD, Ebola virus disease; URTI/LRTI, upper respiratory tract infection/lower respiratory tract infection; UTI, urinary tract infection.

<sup>a</sup>Using multivariate logistic regression, adjusting for sex and age and correcting for multiple comparisons.

for malaria ( $P = .005$ ) and respiratory tract infections ( $P < .001$ ), whereas adults had significantly more visits for myalgia/arthralgia ( $P < .001$ ), vision problems ( $P < .001$ ), post-EVD musculoskeletal disease ( $P = .001$ ), UTI ( $P = .012$ ), and insomnia ( $P = .016$ ) (Table 2).

#### Association of Experiencing Depression With Other Symptoms

The association between patients experiencing depression and other symptoms was assessed for visits during the first 12 months since ETU discharge as symptoms of depression were generally reported during this time frame. Patients experiencing depression ( $n = 42$  patients contributing to 47 patient visits) were significantly more likely to experience stigma, fatigue, palpitations, weight loss, decreased libido, insomnia, pain/numbness, visual problems, anxiety, headache, hearing loss, or diarrhea than patients without depression (Table 4). The strongest association with symptoms of depression was seen in patients who experienced stigma (odds ratio, 26; 95% CI, 4.8–140;  $P = .0002$ ).

## DISCUSSION

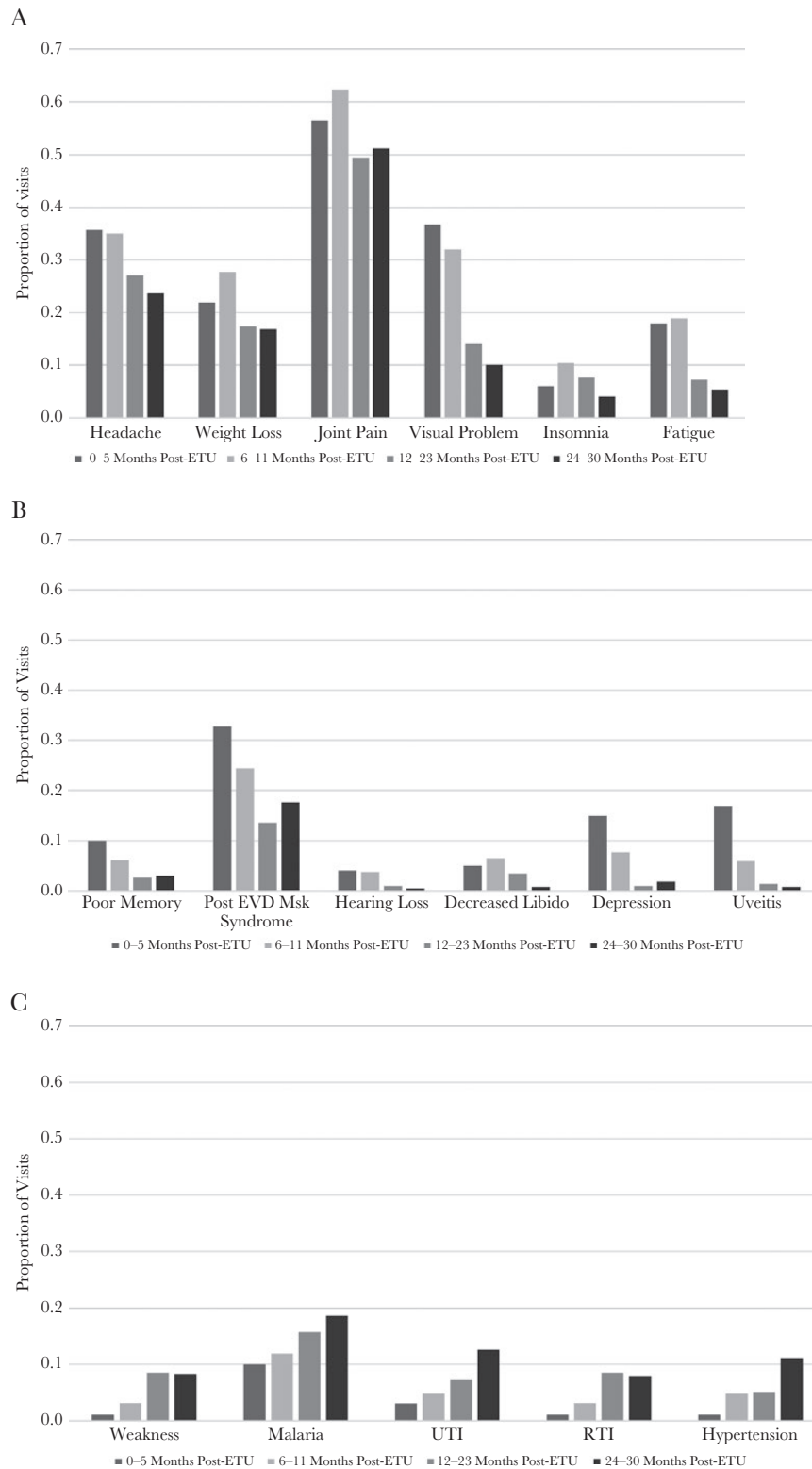
This analysis sought to better understand the development of symptoms in EVD survivors in Liberia in order to optimize care. Using data collected from the medical records during a 2-year time frame, we were able to identify symptoms and diagnoses commonly experienced by EVD survivors. We found that survivors most commonly experienced myalgia/arthralgia,

headache, abdominal pain, and visual problems. These data are similar to those reported in the long-term follow-up of EVD survivors 2 years post-EVD in Uganda, where the most common symptoms experienced by EVD survivors included difficulty sleeping, fatigue, blurred vision, headache, and joint pain [3].

Although numerous studies have characterized EVD sequelae, few have examined the variation of sequelae over time. EVD survivors reported different symptoms early after ETU discharge than they reported months after ETU discharge. A previous comparison of survivors in acute convalescence (0–90 days after ETU discharge) with those in subacute convalescence (91–210 days after ETU discharge) found that the severity of anorexia and arthralgia decreased over time from ETU discharge [6]. Our analysis revealed that the proportion of visits for symptoms associated with acute convalescence, such as weight loss, visual problems, depression, and joint pain, also significantly decreased over time, particularly 12 months after ETU discharge. This finding was significant even when the analysis was limited to patients who had 3 or more visits at ELWA, suggesting that these symptoms may gradually improve due to the natural history of the disease or due to treatment. Weakness increased significantly over time; the underlying mechanism and whether this symptom was related to EVD are unclear. The proportion of visits for non-EVD-related conditions (such as malaria) increased over time, suggesting that EVD survivors began to seek care for more acute illnesses as their chronic symptoms improved. One potential explanation could be that survivors began to see the clinic as a trusted and free source of care and began to seek more regular care at ELWA.

These results suggest that musculoskeletal, visual, psychological, and gastrointestinal problems are most pronounced during the immediate recovery period. Although the exact mechanisms for these findings are not well understood, they may be mediated by immune system activation and viral persistence. EVD triggers a robust immune response and a “cytokine storm” by nonspecifically activating T cells and leading to cytokine production, particularly IL-4 and IFN-gamma [17]. Viral antigen persistence may also trigger persistent immune response and may contribute to persistence of symptoms. In patients with Ebola treated in the United States, abnormalities in cellular immunity were noted for longer than 1 month after recovery from EVD [18]. For example, fractalkine (a marker of T-cell activity that has also been associated with chronic inflammatory diseases including rheumatoid arthritis [19, 20]), remained elevated up to 15 months after recovery from EVD [18]. Further research is needed to better understand the disease process and recovery.

This analysis also revealed an association between age and symptom prevalence. Children accounted for >18% of confirmed Ebola cases in Liberia [15] and for 13% of patients included in this analysis. Children <5 years of age have higher



**Figure 3.** Changes in the prevalence of symptoms per clinic visit since Ebola Treatment Unit (ETU) discharge. Only those that had a significant change in incidence over time are shown in these figures ( $P < .05$ ). Data for those that were nonsignificant are in Supplementary Table 1. A, Proportion of visits for headache, weight loss, joint pain, visual problem, insomnia, and fatigue during each 6-month period from ETU discharge date. B, Proportion of visits for poor memory, post-Ebola virus disease musculoskeletal syndrome (post-EVD MSK syndrome), hearing loss, decreased libido, depression, and uveitis during each 6-month time period. C, Proportion of visits for weakness, malaria, urinary tract infection (UTI), respiratory tract infection (RTI), and hypertension during each 6-month period.

**Table 4. Relationship Between Depression and Symptoms/Diagnoses in Patients who Presented to the EVD Survivor Clinic <12 Months After ETU Discharge (n = 42)<sup>a</sup>**

Symptom/Diagnosis	Adjusted Odds Ratio	95% Confidence Interval	P Value
Experiencing stigma	26	4.8–140	.0002
Fatigue	5.2	2.5–10	<.0001
Palpitations	6.7	2.6–17	.0001
Weight loss	3.7	1.9–7.3	.0002
Decreased libido	5.9	2.3–15	.0002
Insomnia	4.4	1.9–10	.0005
Pain numbness in feet	3.9	1.7–8.8	.0011
Visual problem	2.9	1.5–5.7	.0021
Anxiety	4.1	1.5–11	.0068
Headache	2.6	1.3–5.0	.0078
Hearing loss	4.7	1.3–16	.0155
Diarrhea	5.6	1.3–24	.0204

Abbreviations: ETU, Ebola Treatment Unit; EVD, Ebola virus disease.

<sup>a</sup>Adjusting for multiple comparisons and time from ETU discharge.

case fatality ratios than older children, which may result from a variety of factors, including nutritional status and immunologic response [21]. In this study, children and adults experienced different symptoms, with more adults reporting headache, post-EVD musculoskeletal syndrome, fatigue, insomnia, palpitations, visual problems, and joint problems. This may be due to difficulties in diagnosing some of these symptoms in children as they may be unable to articulate symptoms and physical examination may be more challenging. Differences in age-associated comorbidities may also play a role; in our study, children were noted to have more malaria, which may affect the immune response to other infections such as Ebola. Immune response in pediatric EVD patients has been demonstrated to differ from adults regardless of comorbidities, with children noted to have higher levels of markers of cellular adhesion molecules, cytokines (including RANTES), and macrophage colony-stimulating factor compared with adults [22]. These differences in immune response may also manifest in terms of post-EVD sequela. Physicians caring for EVD survivors should be sure to examine all children thoroughly and discuss potential for symptom development with their caregivers.

Depression at ELWA was diagnosed by patient report of feeling sad, overwhelmed, or “blue.” Our study found that depression was associated with additional symptoms experienced by EVD survivors. Our findings are similar to those of a study of survivors in Guinea where patients with myalgia/arthralgia were found to have higher rates of depression [23]. Some patients may experience physical complaints as a result of depression or post-traumatic stress disorder [24]. On the other hand, patients with multiple physical complaints may also experience depression as a result of having more symptoms and interference with activities of daily living. Both physical complaints and depression may improve with a combination of medications, physical

therapy, and mental health treatment. Liberia has limited mental health care facilities [25], and there are no validated screening tools for depression in this population. Given our findings, mental health care should be strengthened so that depression in EVD survivors can be diagnosed and treated systematically.

ELWA provided a range of treatments for survivors to treat illnesses such as hypertension, depression, or joint pain. In some instances, as the etiology of symptoms was unclear, treatment was focused on symptomatic relief. Patients with musculoskeletal pain anecdotally reported improvement with medications such as anti-inflammatory medications and steroids. Similarly, EVD survivors have reported gastritis symptoms, which have anecdotally responded to treatment with acid suppression therapy (eg, proton pump inhibitors). As our study was retrospective and patients had irregular follow-up intervals, we were unable to quantify whether these treatments were efficacious. However, when we limited our analysis to patients who returned for 3 or more visits, we found that many EVD-related symptoms appeared to decrease over time, including visual problems and post-EVD musculoskeletal pain. Responders planning for further EVD survivor care should consider providing medications for symptomatic relief of survivors and should prospectively collect data on the outcomes of various treatment regimes.

This study is subject to several limitations. Some information in the charts was missing or illegible. We only reviewed outpatient records and did not review hospital admissions. All data were collected retrospectively as part of clinical care, and our study lacked a control group. As a result, we were only able to determine symptoms of patients who sought care in the facility, and it was difficult to distinguish if the clinical experience observed in EVD survivors was unique to their EVD sequelae and distinct from the general population. As we only captured information about patients who sought care at ELWA, we did not have information about EVD survivors who may not seek care because they are asymptomatic. This may explain why a greater proportion of EVD survivors seen at ELWA experienced symptoms than the proportion reported in the Uganda study [3]. Other studies conducted during the 2014–2016 outbreak have similarly described high rates of musculoskeletal pain and headache [6–8, 26], suggesting that selection bias alone may not explain the high rates in our study.

In conclusion, we found that EVD survivors continued to seek care at ELWA for more than 2 years after ETU discharge. As such, physicians should expect to treat sequelae in EVD survivors long after discharge. Symptoms reported differ by patient age and time since ETU discharge. At ELWA, effective survivor care was provided within the existing structure of the hospital, was set up quickly (within months), and continued for more than 2 years without interruptions. Support for EVD survivor services in West Africa should be continued, and funding for support of survivors should be included in planning for future EVD outbreak responses in order to ensure provision of



adequate care both during acute infection and in the postrecovery period. Given the chronicity of EVD-related sequelae, consideration should be given to funding and strengthening existing medical infrastructure in-country to ensure long-term follow-up and care.

### Supplementary Data

Supplementary materials are available at *Open Forum Infectious Diseases* online. Consisting of data provided by the authors to benefit the reader, the posted materials are not copyedited and are the sole responsibility of the authors, so questions or comments should be addressed to the corresponding author.

### Acknowledgments

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